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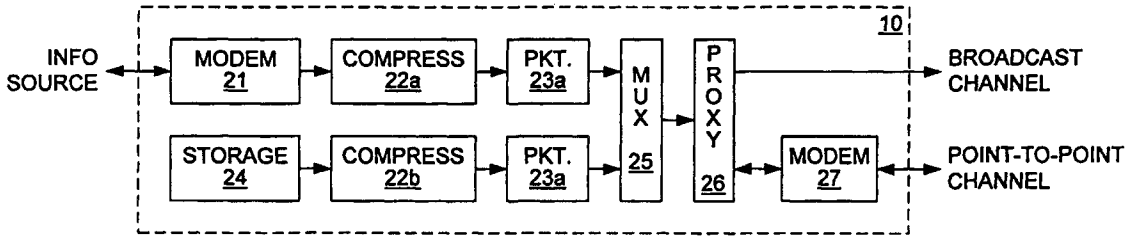

(57) Abstract

A system and method implemented in an interactive television system for managing transmission of data over broadcast and point–to–point channels. In one embodiment, the system comprises a broadcast station (10), a plurality of receiving stations (20), a broadcast channel through which data can be transmitted from the broadcast station to the receiving stations, and a plurality of point–to–point channels (13), each of which is between a corresponding one of the receiving stations and the broadcast station. The broadcast station monitors the demand for particular pieces of information and determines whether the information should be delivered via the broadcast channel or the point–to–point channels. Higher–demand pieces of information are broadcast cyclically over the broadcast channel, while lower–demand information is transmitted over the point–to–point channels.

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TITLE: BANDWIDTH MANAGEMENT ON A HYBRID POINT TO POINT BROADCAST

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to interactive television systems and more particularly to optimization of data delivery in an interactive television system which has both a broadcast channel and a point-to-point channel.

2. Description of the Related Art

Interactive television systems can be used to provide a wide variety of services to viewers. Interactive television systems are capable of delivering typical video program streams, interactive television applications, text and graphic images, web pages and other types of information. Interactive television systems are also capable of registering viewer actions or responses. Interactive television systems can be used for such purposes as marketing, entertainment and education. Users may interact with the systems by ordering advertised products or services, competing against contestants in a game show, requesting specialized information regarding particular programs, or navigating through pages of information.

Typically, a broadcast service provider generates an interactive television signal for transmission to a viewer's television. The interactive television signal may include an interactive portion consisting of application code or control information, as well as an audio-video portion consisting of a television program or other informational displays. The broadcast service provider combines the audio-video and interactive portions into a single signal for transmission to a receiver connected to the user's television. The signal is generally compressed prior to transmission and transmitted through typical broadcast channels, such as cable television (CATV) lines or direct satellite transmission systems.

The interactive functionality of the television is controlled by a set-top box connected to the television. The set-top box receives the signal transmitted by the broadcast service provider, separates the interactive portion from the audio-video portion and decompresses the respective portions of the signal. The set-top box uses the interactive information, for example, to execute an application while the audio-video information is transmitted to the television. The set-top box may combine the audio-video information with interactive graphics or audio generated by the interactive application prior to transmitting the information to the television. The interactive graphics and audio may present additional information to the viewer or may prompt the viewer for input. The set-top box may provide viewer input or other information to the broadcast service provider via a modem connection.

By their nature, interactive television systems provide various different pieces of information which may be displayed to a particular viewer. The interaction of the viewer with the system determines which of the information is presented to him or her as well as what information is transmitted from the viewer back to the system. Interactive television systems may therefore have to transmit large amounts of information to a group of viewers because each of the viewers may request different pieces of the information. As a result of the demand for such large amounts of data, the bandwidth of the system may be insufficient to provide the information to the viewers within a sufficiently short response time.

SUMMARY OF THE INVENTION

The invention provides a method and apparatus for managing an interactive television system to optimize usage of the available bandwidth and minimize the system's response time. In one embodiment, the interactive television system comprises a broadcast station, a plurality of receiving stations, a broadcast channel through which data can be transmitted from the broadcast station to the receiving stations, and a plurality of point-to-point channels, each of which is between a corresponding one of the receiving stations and the broadcast station. Data can be transmitted from the broadcast station over each of the point-to-point channels to the respective receiving stations, as well as from the receiving stations to the broadcast station. The broadcast station monitors the demand for particular pieces of information and determines whether the information should be delivered via the broadcast channel or the point-to-point channels.

In one embodiment, the interactive television system is configured to deliver requested web pages from the broadcast station to the receiving stations. Each of the receiving stations is configured to transmit requests for particular web pages to the broadcast station and to display the requested pages when they are received from the broadcast station. The broadcast station is configured to cyclically broadcast a certain number of web pages on the broadcast channel. After each of the pages has been broadcast once, the series repeats and each of the pages is broadcast again. The broadcast station is also configured to transmit individual web pages on the point-to-point channels.

The broadcast station monitors the requests from the receiving stations and determines which of the requested pages are in higher demand. The pages which have the greatest demand are transmitted to all of the receiving stations on the broadcast channel. Pages which were requested by a particular receiving station are displayed by that receiving station. Pages which were not requested are ignored. Pages which have been requested by fewer receiving stations can be transmitted via the point-to-point channels of the respective receiving stations. Thus, the broadcast channels are used primarily to transmit pages which are requested by a large number of viewers, while the point-to-point channels are used to transmit pages which are requested by a small number of viewers. The use of the system's available bandwidth is thereby used in a way that minimizes the response time between a receiving station's request for a page and delivery of the page to the receiving station. While this embodiment comprises a system for delivering web pages, it is understood that other embodiments may be configured to deliver interactive television applications, multimedia data, or other types of information.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

Fig. 1 is a block diagram illustrating the distribution of interactive television applications and television programs from their sources to a series of viewers.

Fig. 2 is a block diagram illustrating the interconnection of a broadcast station and several receiving stations in one embodiment of the invention.

Fig. 3 is a functional block diagram illustrating the flow of information through the broadcast station in one embodiment of the invention.

Fig. 4 is a block diagram of a set-top box used in one embodiment of the invention.

While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description thereto are not intended to limit the invention to the particular form disclosed, but on the contrary, the intention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the present invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

One embodiment of the invention is described below. In this embodiment, an interactive television system includes a broadcast station and a number of receiving stations. The broadcast station and receiving stations are coupled by a broadcast channel such as direct satellite transmission. ("Broadcast" is used herein to refer to transmission of a single signal to all subscribing receivers. "Direct" satellite transmission as used herein contemplates transmissions received by the interactive television receiver, through its antenna, directly from the satellite.) The broadcast station and receiving stations are also connected by several point-to-point channels, each of which forms a direct channel between the broadcast station and one of the receiving stations.

The broadcast and point-to-point channels may both be used to transmit various pieces of data to the receiving stations. The data may be audio-video-interactive information, such as interactive application modules, or any other type of data, such as web pages. The embodiment described below is configured to transmit web pages. The description of this embodiment, however, is intended to be illustrative rather than limiting, and the transmitted data can represent any type of information, such as application code, raw data or graphical information.

In the described embodiment, the receiving stations are configured to transmit information requests to the broadcast station. The information requests transmitted by a particular receiving station correspond to web pages which the user at the receiving station wishes to view. The broadcast station receives the requests and retrieves the requested pages from the appropriate sources. After the requested pages have been retrieved by the broadcast station, they must be transmitted to the receiving stations which submitted the corresponding requests.

The retrieved pages may be transmitted to the receiving stations via either the broadcast channel or the point-to-point channels. Data transmitted via the broadcast channel is distributed to all of the receiving stations, whether they requested the transmitted pages or not. Data transmitted via the point-to-point channels is distributed only to those receiving stations which requested it, but the broadcast station can only transmit a limited amount of data at one time.

Rather than using only one of these channels to transmit data to the receiving stations, this embodiment of the invention can use both. That is, a particular piece of data such as a web page can be transmitted over either channel. Because the point-to-point channel is not limited to transmitting only narrow-band data, entire web

pages can be transmitted over this channel. The broadcast station need not strip out narrow-band data for transmission over the point-to-point channel while wide-band data is transmitted over the broadcast channel. Similar data (e.g., wide-band data) can be transmitted over either the broadcast channel or the point-to-point channel. Consequently, the decision to transmit particular data over one channel or the other can be based on delivery times or other quality-of-service criteria.

There are a number of factors which influence the decision to transmit data over one channel or the other. For example, since some of the retrieved pages may have been requested by more than one receiving station, it may be more efficient to transmit these pages via the broadcast channel, while pages requested by a single receiving station may be more efficiently transmitted via the point-to-point channel. In another example, interactive application modules which are needed by larger numbers of subscribers may be transmitted via the broadcast channel, while modules which are needed by fewer subscribers may be transmitted via the point-to-point channels.

Thus, in some instances, it may be advantageous to transmit data over the broadcast channel. For example, when the point-to-point channel would require an inordinately large amount of time to deliver the data or when transmission over the broadcast channel is necessary to meet quality-of-service criteria, the broadcast channel is selected for transmission of the data. The broadcast station may therefore monitor the requests from the receiving stations to determine which of the pages are in greater demand (i.e., which are requested by a greater number of receiving stations.) When the requested pages are retrieved, those which are in the greatest demand are transmitted via the broadcast channel.

In other instances, it may be advantageous to transmit data over the point-to-point channel. For example, when the broadcast channel is heavily loaded with transmission of high-demand data, it may be preferable to transmit a module which has been requested by a single subscriber via the point-to-point channel. There may also be instances in which the transmission quality of the point-to-point channel is greater than that of the broadcast channel, in which case certain modules may need to be transmitted via the point-to-point channel.

Referring to Fig. 1, a block diagram illustrating the distribution of information such as web pages from their sources to a series of viewers is shown. (It should be noted that web pages are exemplary, rather than limiting, of the types of data which may be transmitted and other types of data, such as application modules, image data, and the like may also be transmitted in the various embodiments of the invention.) Broadcast station 10 has several program sources 11. In one embodiment, sources 11 are web servers which may be accessed by broadcast station 10 to obtain web pages. In other embodiments, the sources may include remote broadcast network feeds, videotape recorders, computers, data storage devices, and the like. Sources 11 provide audio-video information which is to be included in the interactive television signal. The information from sources 11 is transmitted to receiving station 20 via either a broadcast channel or a point-to-point channel . The broadcast channel is depicted in the figure as a direct satellite broadcast channel formed by broadcast antenna 12, communications satellite 15 and receiving antenna 19. Although the figure illustrates a satellite transmission, it is contemplated that any broadcast medium, including non-satellite, CATV (cable), telco (telephone), MMDS (microwave) and terrestrial transmissions, may be used. The point-to-point channel may comprise an ordinary telephone line 13 connected to a transmitting modem in the broadcast station and a receiving modem in the receiving station (not shown). The point-to-point channel may comprise other transmission media in other

embodiments. The point-to-point channel is typically used to transmit user data from the receiving station to the broadcast station. The point-to-point channel also provides an alternate path for web pages and other pieces of information from sources 11 to be delivered to receiving station 20.

Referring to Fig. 2, the interconnection of broadcast station 10 and several receiving stations 20 is shown. (For convenience, items having reference numerals followed by a letter are collectively referred to by the reference numeral without a letter.) The figure illustrates that broadcast channel 14 transmits a single broadcast signal to each of receiving stations 20, while point-to-point channels 13 separately connect each of the receiving stations to the broadcast station. A signal on one of the point-to-point channels is therefore independent of the signals on the other point-to-point channels.

Referring to Fig. 3, a functional block diagram illustrating the flow of information through broadcast station 10 is shown. In one embodiment, web pages are received from web servers via modem 21. The web pages may be compressed by compression units 22 in order to conserve bandwidth. Any one of a number of compression algorithms may be used if appropriate for a particular program or application. Some web pages may not be easily or effectively compressed, so some of the information may bypass compression units 22 and be passed from the modem to packetization units 23 without compressing the information. Packetization units 23 accept the compressed (or uncompressed) information and format it into packets for transmission over the broadcast channel. The figure also shows storage unit 24, which may provide previously obtained information, stored data or some other type of information to compression unit 22 and packetization unit 23. The components of broadcast station 10 are coupled to a control unit (not shown) which manages the functions of the broadcast station.

The packets from packetization units 23 are fed into multiplexing unit 25, which may intersperse the packets with each other or with control information prior to transmission. The interspersed packets are then passed to proxy server 26. Proxy server 26 monitors the web page requests submitted by the users and determines the demand for the different web pages. Typically, high-demand pages are transmitted on the broadcast channel, while lower-demand pages are transmitted via the point-to-point channel. In the illustrated embodiment, the point-to-point channel is represented by modem 27, which transmits the page to a single user via a phone line (not shown).

While other types of controllers or processors could be used to implement the monitoring function of the broadcast station, a proxy server is used in this embodiment. In addition to monitoring the information requests, the proxy server can perform other functions, such as filtering the requests or caching information responsive to the requests. The use of a proxy server may also increase the scalability of the system, as more proxy servers can be added to handle the load from the receiving stations.

Because pages transmitted via the broadcast channel are received by all users, pages which have been requested by a large number of users are most efficiently distributed over this channel. Each of the requests can be serviced simultaneously and the response time is kept to a minimum. Pages which are requested by smaller numbers of users may be more efficiently transmitted via the point-to-point channels between the broadcast station and the respective receiving stations. It is also contemplated that the choice of channels may be based on anticipated demand, rather than the actual number of requests for particular pages. For example, if a commercial for a certain manufacturer is broadcast, it may be anticipated that a large number of requests for that

manufacturer's web page will be received. The manufacturer's web page may therefore be transmitted over the broadcast channel while other web pages are transmitted over the point-to-point channels.

It is contemplated that the receiving station may be configured to transmit pieces of information in a cyclic manner. That is, a certain number of these pieces of information (e.g., web pages) are transmitted one after the other and then, after each of the pieces of information has been transmitted a first time, they are transmitted a second time and a third time and so on. The broadcast station thus continuously broadcasts data, with each piece of information being re-broadcast at regular intervals (i.e., each piece of information is re-broadcast with a certain frequency). The broadcast station may also be configured to transmit multiple carousels which have different periodicities.

As noted above, the pieces of information which are broadcast in this manner may be referred to as a carousel. Because there may be a limited number of positions or slots in the carousel, the broadcast station must prioritize the requested pieces of information. The determination of whether a piece of information will be transmitted via the broadcast channel or the point-to-point channel depends on its priority and the number of slots in the carousel. If only a few web pages are requested by users, it may be possible to transmit all of them, including low-demand pages, via the broadcast channel. In fact, the need to meet certain criteria for quality of service may influence the number of slots in the carousel and the periodicity of carousel transmissions. On the other hand, there may be instances in which the number of high-demand pages exceeds the number of allowable slots in the carousel, and some of them may have to be transmitted via the point-to-point channel.

Various strategies may be used to determine which pages are transmitted by which channel. If one or more pages are in particularly high demand, they may be allocated two slots in the carousel so that it is transmitted with a greater frequency. Responses to requests for these pages will therefore have a reduced latency (response time.) If there is a particularly large number of pages for which there is only a low or moderate demand, the size of the carousel may be increased. (It should be noted that the carousel is not a hardware structure, and that the number of slots in the carousel is determined by the system software based on system and performance constraints.) The strategy for routing data via the respective channels may also take into account other factors, such as degraded quality of transmissions on the point-to point channel. For example, if a modem channel is too noisy to transmit error-free data, or if this channel simply doesn't meet the quality-of-service criteria, the cyclic broadcast of high-demand data may be interrupted so that low-demand data can be transmitted over the broadcast channel.

Receiving station 20 is contemplated to be one of a number of stations which are subscribers of the broadcast service provider operating broadcast station 10. The broadcast signal is collected by receiving antenna 19 and fed to receiving station 20, which in one embodiment is contemplated to be a set-top box coupled to a television set. Set-top box 22 processes the packetized signal to reconstruct the information embodied in the signal (e.g., web pages.) The reconstructed information is processed in the set-top box and, if appropriate, transmitted to the television to be displayed. Web pages may be directed to the television, while information comprising an interactive applications may be executed in the set-top box rather than being displayed. Interactive applications may, however, generate graphics or audio which are combined with other information and then displayed.

Referring to Fig. 4, a block diagram of a set-top box 22 is shown. The broadcast signal is received and fed into tuner 31. Tuner 31 selects a particular broadcast channel on which the broadcast audio-video-interactive signal is transmitted and passes the signal to processing unit 32. (Tuner 31 may be replaced by other means, such as simple input ports, for receiving signals from various signal sources.) Processing unit 32 demultiplexes the packets from the broadcast signal if necessary and reconstructs the information embodied in the signal. The information is then decompressed by decompression unit 33. The information is then conveyed to display unit 34, which may perform further processing and conversion of the information into a suitable television format, such as NTSC or HDTV audio/video. If the information includes interactive applications, these applications are reconstructed and routed to random access memory (RAM) 37. The applications are then executed by control unit 35.

Control unit 35 may include a microprocessor, micro-controller, digital signal processor (DSP), or some other type of software instruction processing device. RAM 37 may include memory units which are static (e.g., SRAM), dynamic (e.g., DRAM), volatile or non-volatile (e.g., FLASH), as required to support the functions of the set-top box. When power is applied to the set-top box, control unit 35 executes operating system code which is stored in ROM 36. The operating system code executes continuously while the set-top box is powered in the same manner the operating system code of a typical personal computer (PC) and enables the set-top box to act on control information and execute interactive and other applications. The set-top box also includes modem 38. Modem 38 is connected to the telephone line which provides the point-to-point channel between the receiving station and the broadcast station. This channel may serve both as a means for transmitting requested data from the broadcast station to the receiving station and as a return path by which the user can transmit information requests to the broadcast station.

Set-top box 22 may include a module manager unit 30 contained within control unit 35. Since the receiving station is not aware of the whether it has requested modules which are in high demand from other receiving stations, module manager unit 30 monitors tuner 31 and modem 38 for the requested information. (Tuner 31 in this case is the receiving station's connection to the broadcast channel and modem 38 is its connection to the point-to-point channel.) In other embodiments, the receipt of requested information may be controlled in a different manner. For example, the broadcast station may be configured to transmit notification to the receiving station on a predetermined channel to inform the receiving station which of the channels will be used to transmit the requested information. In one embodiment, module manager unit 30 is implemented in software, but it may also be implemented in hardware or a combination of hardware and software. Module Manager unit 30 may be used to control the receipt of audio-video information via the broadcast and point-to-point channels.

Although the term "set-top box" is used herein, it is understood that this term refers to any receiver or processing unit for receiving and processing a transmitted signal and conveying the processed signal to a television or other monitor. The set-top box may be in a housing which physically sits on top of a television, it may be in some other location external to the television (e.g., on the side or back of the television or remotely located from the television), or it may be incorporated into the television itself. Set-top box 22 serves to demodulate the signal received from broadcast station 10 and to separate the components of the signal, such as web pages, television programs and interactive applications. Similarly, the television set may be a television or a

video monitor employing any suitable television format (e.g., NTSC or HDTV), or it may be replaced by other devices, such as a video recorder.

In the embodiment described above, the broadcast channel is a direct satellite transmission channel. The broadcast channel may alternately utilize various transmission media and is contemplated to include media such as coaxial cable and free space (e.g., as used for direct satellite transmissions.) The return path typically consists of a pair of modems, one in the receiving station and one in the broadcast station, each connected to a standard telephone line. Other means for establishing a return path, however, are also contemplated. For example, a portion of the bandwidth of the transmission path could be used as the return path. If the return path utilizes a portion of the broadcast bandwidth, it is contemplated that the broadcast station may still employ a separate point-to-point channel (e.g., a telephone line) to transmit requested data to the receiving station.

In considering the alternate embodiments of the invention, it may be helpful to view the channels of communication between the broadcast station and receiving station as three logical links: a broadcast link; a point-to-point link; and a return link. As described above, the broadcast link is used to transmit data to multiple receiving stations. The point-to-point link is used to transmit data to individual receiving stations. The return link is used to transmit data to the broadcast station. These logical links may be mapped to a wide variety of physical media, some of which are shared (e.g., satellite transmissions) and some of which are separate, or point-to-point (e.g., telephone lines). More specifically, the broadcast logical link must be mapped to one of the shared media. The point-to-point and return links may be mapped to either the shared media, or the separate media. It is even possible to split the logical links and map them to more than one medium. For example, a point-to-point logical link may be mapped to a shared medium such as a satellite (for transmissions to the receiving station) and at the same time mapped to a separate medium such as a telephone line (for transmissions to the broadcast station).

Just as various aspects of the invention described above may vary in different embodiments of the invention, other details of these embodiments may also be modified without departing from the spirit and scope of the invention as defined by the appended claims. The embodiments described above are intended to be exemplary rather than limiting, and it is contemplated that the scope of the invention includes various modifications and embodiments which will be apparent to those skilled in the art of the invention.

WHAT IS CLAIMED IS:

1. In an interactive television system having a plurality of receiving stations, a broadcast station comprising:

a broadcast channel coupled to each of said receiving stations, said broadcast channel being configured to simultaneously transmit information to all of said receiving stations;

a plurality of point-to-point channels, each said point-to-point channel coupled to a corresponding one of said receiving stations, each said point-to-point channel being configured to transmit information to said corresponding one of said receiving stations, each said point-to-point channel being further configured to transmit requests to said broadcast station; and

a control unit configured to

monitor a plurality of requests from said receiving stations, each said request indicating a corresponding piece of information

for each said piece of information, select one of said broadcast channel and said point-to-point channels for transmission of said piece of information, and

transmit each said piece of information via said one of said broadcast channel and said point-to-point channels selected for said piece of information.

2. The interactive television system of claim 1 wherein said control unit is configured to associate a demand level with each said piece of information based at least in part on the number of requests for said piece of information and to select said broadcast channel if said associated demand level is above a threshold level and to select said point-to-point channel if said associated demand level is below said threshold level

3. The interactive television system of claim 2 wherein each of said point-to-point channels comprises a telephone line.

4. The interactive television system of claim 3 wherein said point-to-point channels are configured to serve as a return path between said broadcast station and said receiving stations.

5. The interactive television system of claim 1 wherein said control unit is coupled to a plurality of information sources, wherein said control unit is configured to obtain said pieces of information from said information sources, and wherein each of said broadcast and point-to-point channels is configured to transmit said pieces of information from each of said information sources.

6. The interactive television system of claim 5 wherein one of said information sources is a storage unit for said pieces of information.

7. The interactive television system of claim 1 wherein said pieces of information assigned to said broadcast channel form a carousel and wherein said broadcast station is configured to transmit said pieces of information in said carousel in a cyclic manner.

8. The interactive television system of claim 7 wherein said carousel has a plurality of slots and wherein one of said pieces of information occupies more than one of said slots.

9. The interactive television system of claim 8 wherein said pieces of information comprise web pages.

10. The interactive television system of claim 1 wherein said broadcast channel and said point-to-point channels are configured to transmit identical types of said pieces of information.

11. A method for managing the transmission of data from a broadcast station to a plurality of receiving stations wherein each receiving station is coupled to the broadcast station by a broadcast transmission channel and a point-to-point transmission channel, the method comprising:

transmitting a plurality of information requests from said receiving stations to said broadcast station;

monitoring said information requests;

obtaining pieces of data corresponding to said information requests;

assigning said pieces of data to be transmitted to one or more of said receiving stations via one of said broadcast transmission channel and said point-to-point transmission channel; and

transmitting said pieces of data to one or more of said receiving stations.

12. The method of claim 11 further comprising prioritizing said information requests and assigning said pieces of data to be transmitted to one or more of said receiving stations via one of said broadcast transmission channel and said point-to-point transmission channel based on said prioritization of said corresponding information requests

13. The method of claim 12 wherein monitoring said information requests comprises counting a number of requests corresponding to each said piece of data.

14. The method of claim 13

wherein prioritizing said information requests comprises assigning a priority to each of said information requests, said priority being higher if said number of requests is higher and lower if said number of requests is lower; and

wherein assigning said pieces of data to one of said broadcast transmission channel and said point-to-point transmission channel includes

assigning each said piece of data to said broadcast transmission channel if said piece of data corresponds to a high priority information request; and

assigning each said piece of data to said point-to-point transmission channel if said piece of data corresponds to a low priority information request.

15. The method of claim 14 wherein transmitting said pieces of data comprises:

transmitting said pieces of data corresponding to said high priority information requests in a cyclic manner on said broadcast transmission channel; and

transmitting said pieces of data corresponding to said low priority information requests on ones of said point-to-point transmission channels corresponding to said low priority information requests.

16. The method of claim 11 wherein each of said broadcast channel and said point-to-point channel are configured to transmit similar types of data and wherein assigning said pieces of data to one of said broadcast transmission channel and said point-to-point transmission channel is based on one or more quality-of-service criteria.

17. An interactive television system comprising:

a broadcast station;

a plurality of receiving stations;

a broadcast channel coupled to said broadcast station and said plurality of receiving stations; and

a plurality of point-to-point channels, wherein each of said point-to-point channels is coupled to a corresponding one of said receiving stations and to said broadcast station and wherein each said point-to-point channel is configured to transmit the same type of data as said broadcast channel;

wherein said receiving stations are configured to transmit information requests to said broadcast station; and

wherein said broadcast station is configured to

monitor said information requests and

select one of said broadcast and said point-to-point channels for transmission of pieces of information responsive to each said information request and

transmit said pieces of information responsive to each said information request via said selected channel.

18. The interactive television system of claim 17 wherein said broadcast station is configured to select said broadcast and said point-to-point channels for said pieces of information based on a number of said information requests corresponding to each said piece of information.

19. The interactive television system of claim 18 wherein said pieces of information comprise a first group and a second group, each said piece of information in said first group corresponding to at least a first number of said information requests, each said piece of information in said second group corresponding to no more than said first number of said information requests.

20. The interactive television system of claim 19 wherein said broadcast station is configured to transmit said pieces of information in said first group via said broadcast channel.

21. The interactive television system of claim 20 wherein said broadcast station is configured to transmit said pieces of information in said first group in a cyclic manner.

22. The interactive television system of claim 21 wherein said broadcast station is configured to transmit each of said pieces of information in said first group with a corresponding frequency, and wherein said frequency of one or more of said pieces of information is higher than said frequency of the remainder of said pieces of information.

23. The interactive television system of claim 17

wherein said broadcast station is configured to transmit to said receiving station via a predetermined one of said broadcast channel and said point-to-point channels a signal corresponding to one of said pieces of information, said signal indicating which of said broadcast channel and said point-to-point channels will be used to transmit said corresponding piece of information and

wherein said receiving stations are configured to monitor said predetermined one of said broadcast channel and said point-to-point channels for said signal and to receive said corresponding piece of information on said one of said broadcast channel and said point-to-point channels indicated by said signal.

24. The interactive television system of claim 17

wherein said receiving stations are configured to monitor said broadcast channel and said point-to-point channels for said pieces of information.

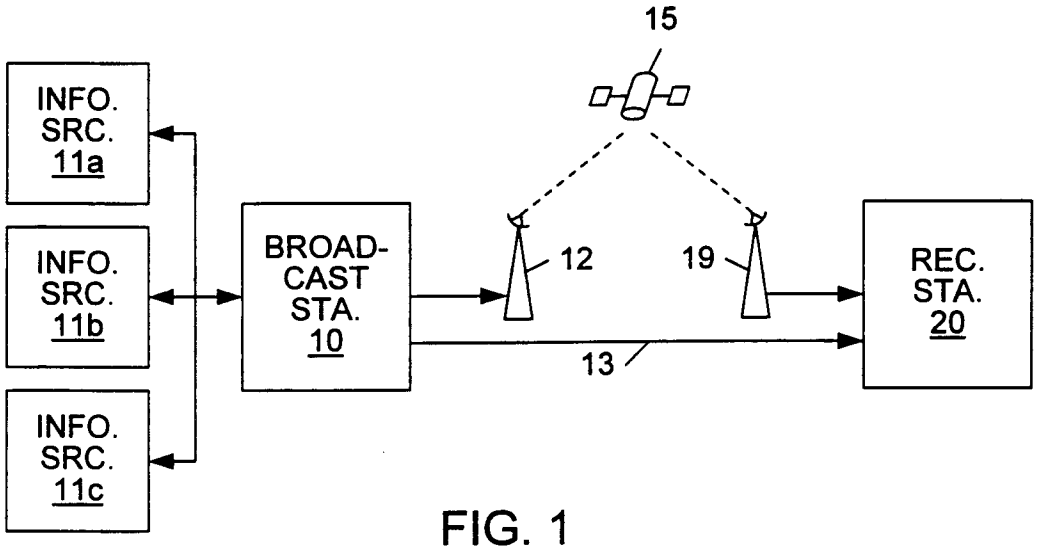
15
INFO. SRC. 11a
INFO. SRC. 11b
INFO. SRC. 11c
BROAD-CAST STA. 10
12
19
REC. STA. 20
13

FIG. 1

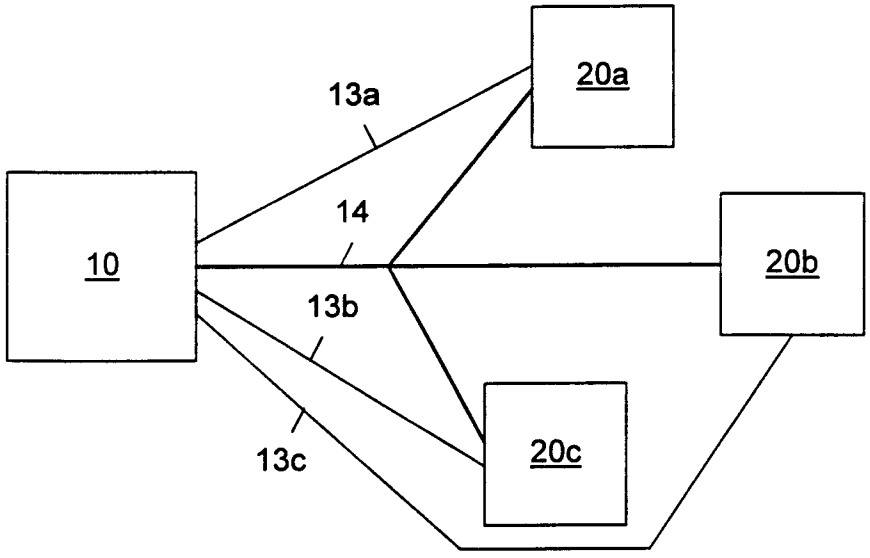
20a
13a
14
10
20b
13b
20c
13c

FIG. 2

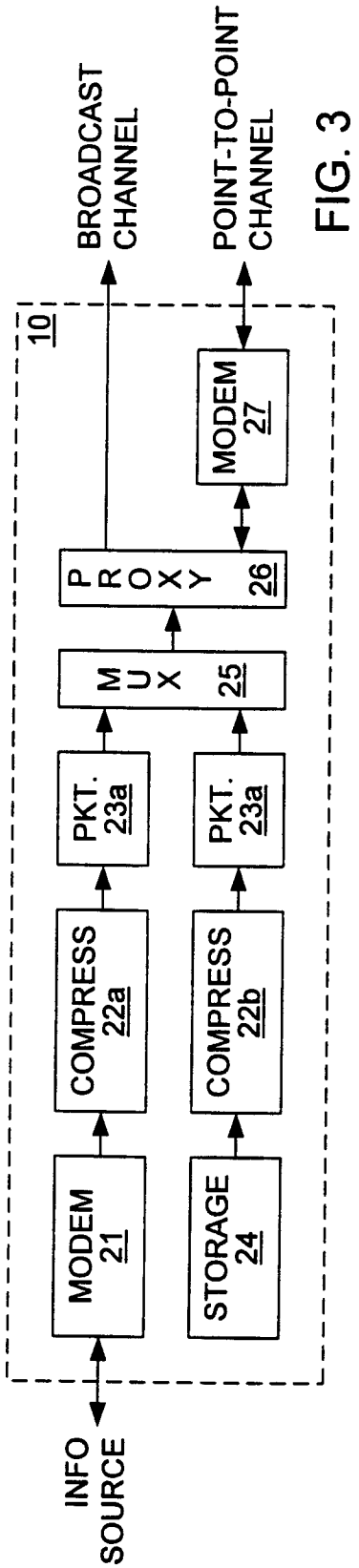
INFO SOURCE
10
MODEM 21
STORAGE 24
COMPRESS 22a
COMPRESS 22b
PKT. 23a
PKT. 23a
MUX 25
PROXY 26
MODEM 27
BROADCAST CHANNEL
POINT-TO-POINT CHANNEL

FIG. 3

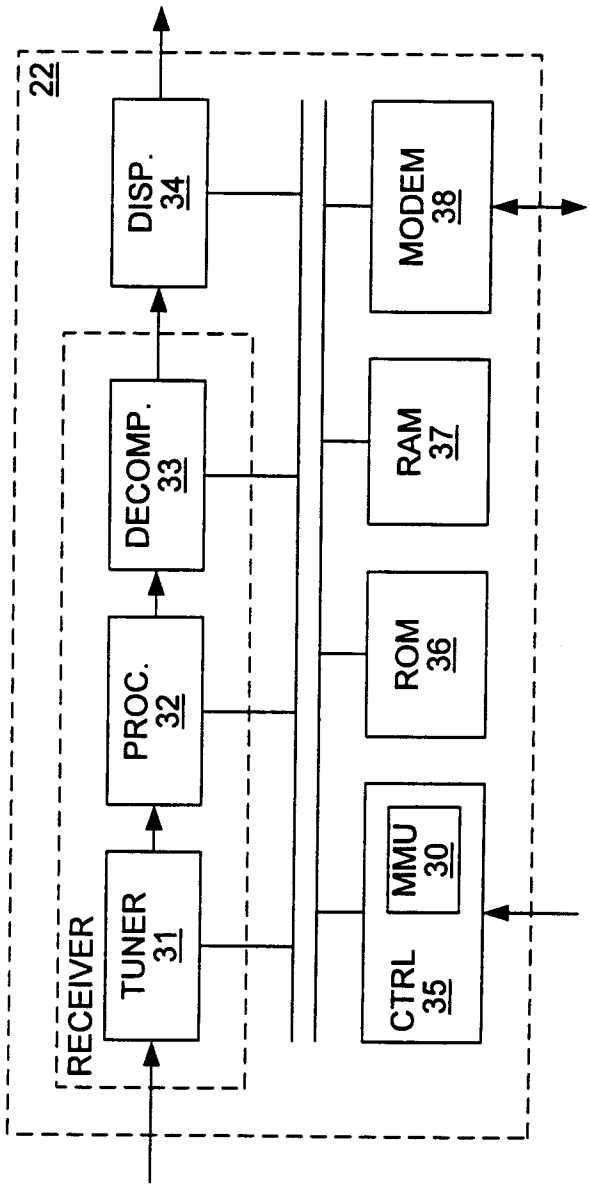
22
RECEIVER
TUNER 31
PROC. 32
DECOMP. 33
DISP. 34
CTRL 35
MMU 30
ROM 36
RAM 37
MODEM 38

FIG. 4

INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/US 00/09276

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04N7/173

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04N G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 98 26528 A (ADDINGTON TIMOTHY H ;DEFREESE DARRYL L (US); SCIENTIFIC ATLANTA (U) 18 June 1998 (1998-06-18)	1,11,17
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A	page 7, line 10 -page 9, line 8	2-10, 12-16, 18-24

A	EP 0 786 718 A (FUJITSU LTD) 30 July 1997 (1997-07-30) column 3, line 55 -column 5, line 29	1-24

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
14 June 2000	26/06/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040. Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Greve, M

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INTERNATIONAL SEARCH REPORT

Inte ..ional Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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